

REMARKS

Claims 1, 2, 4-5, 7, and 9 are pending in this application. By this Amendment, claims 1 and 4 are amended and claims 3, 6, and 8 are canceled. Support for the amendments can be found, for example, in original claims 3-4, and 6; and in the specification at paragraph [0010]. No new matter is added. Reconsideration of the application based upon the above amendments and the following remarks is respectfully requested.

Entry of the amendments is proper under 37 CFR §1.116 because the amendments:

(a) place the application in condition for allowance, for the reasons discussed herein; (b) do not raise any new issue requiring further search and/or consideration, as the amendments amplify issues previously discussed throughout prosecution; and (c) place the application in better form for appeal, should an appeal be necessary. The amendments are necessary and were not earlier presented because they are made in response to arguments raised in the final rejection. Entry of the amendments is thus respectfully requested.

I. Rejection Under 35 U.S.C. §103(a)

Claims 1-9 are rejected under 35 U.S.C. §103(a) over Hiroko et al. ("Hiroko", JP 05-078289). Applicants respectfully traverse the rejection as to amended claims 1, 2, 4-5, 7, and 9.

Independent claim 1 specifies, *inter alia*, a method comprising reducing a nitro group on the 2,2-dimethyl 2H-1-benzopyran compound of formula (1) with hydrazine in the presence of platinum or palladium as a metal catalyst to produce the aminobenzopyran compound of formula (2). Such a method would not have been obvious over the cited reference.

At most, Hiroko discloses reducing the nitro group of its disclosed Formula 3 with hydrazine in the presence of a palladium/activated carbon or platinum/activated carbon catalyst to produce a compound represented by its disclosed Formula 1 (Hiroko, paragraphs

[0007]-[0009] and [0017]). The Office Action asserts that although the starting (and ending) compounds are different, they are analogous compounds and thus have analogous products. The Office Action also states that the use of analogous starting materials in a well-known process is *prima facie* obvious. The Office Action further states that there is no evidence in the specification or the prior art that any part of the starting reagents other than the NO₂ group is involved in the reaction process. Applicants respectfully disagree with the Office Action.

Formula (1) of the present claims contains a nitro group that is reduced with hydrazine in the presence of a metal catalyst. In Formula (1) of claim 1, the nitro group is attached directly to a benzopyran group. The object of the claimed invention is to reduce or eliminate the formation of the by-product (5). See specification at paragraph [0038]. As shown in the specification, by-product (5) is formed when the unstable olefin bond, which is present on the ring of the benzopyran group that contains the heteroatom, is reduced. This process is very different from, and involves different reactions and by-products than, the method of Hiroko. In contrast, Hiroko simply discloses a nitro group that is attached to a single benzene group, which is a much more stable group than hydrazine. In Hiroko, the single benzene group is further attached to a naphthalene group by an ether group. However, nowhere does Hiroko teach or suggest any compound containing the significantly less stable benzopyran group. Hiroko thus fails to teach or suggest the reduction of a nitro group that is directly attached to a benzopyran group, as claimed.

The method of the claimed invention is a non-obvious advancement over the prior art of making the desired compound, because the claimed process effectively inhibits the formation of by-product (5) and thereby provides the desired aminobenzopyran compound in a very high yield. This occurs because the method of the present claims confers a high reaction selectivity on the nitro group while leaving the benzopyran backbone group intact. Thus, compounds of formula 3 of Hiroko are not analogous starting materials to compounds

of formula (1) of the present claims, because Hiroko's Formula 3 does not contain a nitro group directly bonded to a relatively less stable (or more reactive) benzopyran group. Formula 3 of Hiroko contains only highly stable benzene rings. Thus, Hiroko's reaction does not have a side reaction that produces a similar by-product. In addition, nowhere does Hiroko teach or suggest that the disclosed reaction inhibits the formation of by-products by conferring high reaction selectivity on the nitro group. Hiroko thus fails to teach or suggest a method for producing an aminobenzopyran compound of formula (2), as claimed.

Given the teaching of Hiroko, it would not have been obvious to try to reduce the nitro compound of the present claims with hydrazine in the presence of a platinum or palladium catalyst because Hiroko does not teach or suggest a method of conferring a high reaction selectivity on the nitro group using a platinum or palladium catalyst, particularly when benzopyran groups are also present. Thus, there would have been no motivation to try reducing the nitro group of formula (1) of the present claims with the metal catalyst and hydrazine of Hiroko with any reasonable expectation of success.

The Office Action further asserts, in the alternative, that based upon the teachings of Hiroko "one would have known to reduce any nitro compound with hydrazine in the presence of a platinum or palladium catalyst at the time the invention was made." Applicants respectfully disagree. The object of the presently claimed invention is not to simply reduce any nitro group present on any benzene ring. The object of the presently claimed invention is to selectively reduce only a nitro group that is present on a nitrobenzopyran compound, which additionally contains a relatively less stable (or more reactive) olefin bond on the ring containing the heteroatom. The presently claimed invention reduces this specific nitro group without also reducing the olefin bond of the nitrobenzopyran compound.

In addition, the reduction of the nitrobenzene portion of the nitrobenzopyran group to aniline may be carried out according to several known methods. These methods include

using hydrazine, hydrogen gas or ammonium formate as the hydrogen source. These methods may also additionally use iron chloride or tin as the catalyst for the reduction instead of platinum or palladium. In many of these known methods, the olefin bond is reduced such that an undesirable by-product is formed. The formation of undesirable by-products for various known methods is shown in Table 2 and Comparative Example 8 of the present specification. *See* specification at paragraphs [0042]-[0046].

As further illustrated by Comparative Example 8, even when hydrazine is used as a hydrogen source, the olefin double bond of the nitrobenzopyran group is reduced if the catalyst is any compound other than platinum or palladium. For example, Comparative Example 8 uses iron chloride ($\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$) and results in a relatively high HPLC area percentage of by-product formation. *See* specification at paragraph [0046]. Consequently, the high selectivity for the desired product, which the present invention aims to accomplish, is difficult to achieve.

Furthermore, at the time of the invention, the only known method where the nitro group was reduced without also reducing the olefin bond of the benzopyran group utilized tin as the metal catalyst. In contrast, the substrate used in Hiroko does not contain a corresponding olefin double bond. Instead, Hiroko's compound simply contains a benzene ring. Hiroko thus fails to teach or suggest the object of the presently claimed invention, wherein the platinum or palladium catalyst selectively reduces the nitro group of a benzopyran compound having an olefin bond without also reducing the olefin bond. Hiroko thus fails to teach or suggest a method for producing an aminobenzopyran compound of formula (2), as claimed.

Additionally, given the teaching of Hiroko, it would not have been obvious to try to reduce the nitro compound of the present claims with hydrazine in the presence of a platinum or palladium catalyst because Hiroko does not teach or suggest a method of conferring a high

reaction selectivity on the nitro group using a platinum or palladium catalyst, particularly when olefin bonds are also present. Thus, there would have been no motivation to try reducing the nitro group of formula (1) of the present claims with the metal catalyst and hydrazine of Hiroko with any reasonable expectation of success.

Claims 2, 4-5, 7, and 9 variously depend from independent claim 1. Because Hiroko fails to teach or suggest the features recited in independent claim 1, dependent claims 2, 4-5, 7, and 9 are patentable for at least the reasons that claim 1 is patentable, as well as for the additional features they recite.

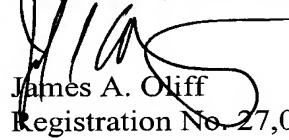
Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

II. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of this application are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,


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